

Bryophyte Biology, Systematic and Field Techniques Training

Held at National University of Rwanda from 1st to 8th October, 2012



Introduction

Today, bryophytes help scientists understand climate change since they are known as good environmental indicators. Besides, by absorbing moisture from the air, they help support ecosystems rich in diversity. Bryophytes do not have roots and extract moisture and nutrients from the air. Thus, they are very susceptible to environmental change. These plants act like sponges and their able to store huge amount of water. Bryophytes and ferns are actually used as indicators of climate change.

Scientists from the National University of Rwanda and other government institutions considered as nodes and hub of the centre of excellence in biodiversity, were trained in bryophytes biology, taxonomy and field techniques. Eleven trainees were from National University of Rwanda, Rwanda Agriculture Board, ISAE, Kigali Institute of Education and Rwanda Development Board.

Theoretical lectures were given and sampling methods in various bryophytes habitats in Nyungwe National Park were the main field activities. The training took place from 01^s to 08th October 2012 at the National University of Rwanda in Biology department. In the first round, trainees followed theoretical lectures on bryophytes. Thereafter; field work was carried out in Nyungwe National Park where trainees had more practices in sampling methods and techniques. The last round of the training consisted of two days identification during which the collected specimens from Nyungwe forest were identified in NUR laboratory. During identification, the interaction between the trainer and trainees facilitated more in gaining skills about key determinations for different groups, genera and species of bryophytes.

The course had the following training objectives:

1. Introduction on bryophytes biology
2. Train scientists in methods and techniques of bryophytes sampling
3. Develop the capacity of trainees in Bryophytes taxonomy at least to genus level of identification.

The lectures given in the class followed the course outline (see appendix I).

Field training

Site description

Field visits were arranged for trainees in different sites of Nyungwe forest. Nyungwe National Park is among the most diverse and important montane forests in East Africa (Figure 1). It is famous mainly for its diversity in primates (13 species) and birds (285 species). Also the flora and vegetation are unique harbouring 47 local endemic species of flowering plants and about 280 Albertine Rift endemics. Nyungwe also shows a picturesque landscape comprising the largest peat bog (Kamoranzovu swamp) in tropical Africa which is surrounded by forests with high epiphyte diversity and large moss cushions. Nyungwe forms a part of the isolated mountain ranges of Africa. Their flora consists of 80% of plants which are not known elsewhere, i.e. endemics (Fischer, E. & Killmann, D., 2008).

Different sites were visited comprising Kamoranzovu water fall, Kamiranzovu swamp, Karamba and Bigugu Mountain (Figure 2).



Figure 1. Different visited sites of Nyungwe National Park, Rwanda

Kamiranzovu swamp site

Kamiranzovu Swamp is the largest peat bog in Africa and was the habitat of the last elephant. It is dominated by *Cyperus* species. The marginal zone is characterized by bushes (e.g. *Syzygium rowlandii*, *Apodytes dimidiata*, *Hymenodictyon floribundum*) which are densely covered with cushions of bryophytes, lichens and vascular epiphytes.

Karamba Site

Karamba site is a savannah like included in the forest. It has different species in bryophytes including mosses with *Sphagnum* being the most dominant in the bog.

Bigugu Site

Bigugu Mountain is covered by a community which is dominated by *Erica bequertii*. Other shrubs are *Vaccinium Stanleyi*, *Struthiola thomsonii* and *Hedythyrus thamnoideus*. The herb layer contains only a few vascular plants and a dense bryophytes layer with dominant *Breutelia stuhlmanii*, *B. subgnaphalea*, *B. diffracta*, *Sphagnum strictum* ssp. *Pappeanum* and *Leptodontium luteum*.

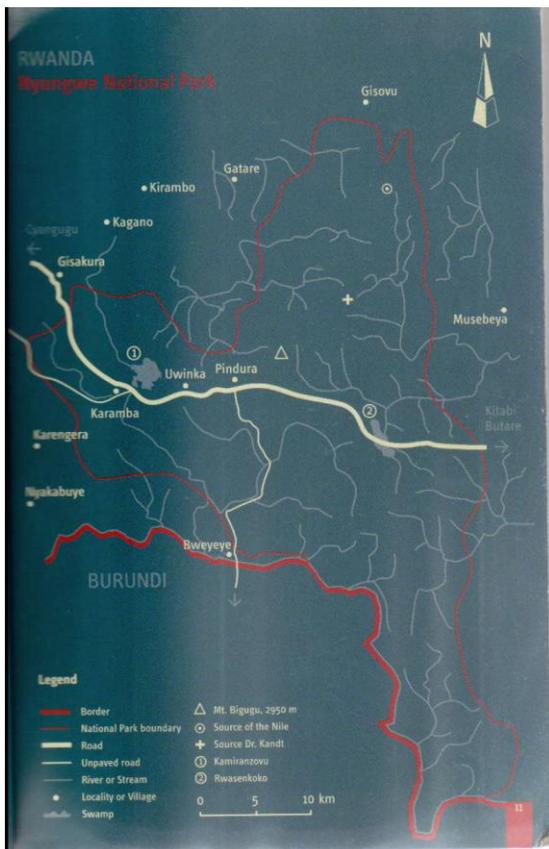


Figure 2. Illustration of visited sites on the map of Nyungwe National Park, Rwanda

Sampling strategies and field techniques

Sampling techniques were introduced to the trainees. Demonstrations were made on how to make plots and within plot how to make quadrant and prepare various equipment needed to collect samples (Figure 3). The sampling procedures consisted of:

Plot size (10x10m): Measured using a Tape measure

Quadrant (2mx2m): measured using a Tape measure

With a quadrant, three trees were selected as micro habitats and samples were taken on different height following 0 cm, 50 cm and 100 cm. To enable the participation of each of the trainees working groups were chosen as best method.



Figure 3. Trainees sampling in one of plots of Kamiranzovu Swamp

Materials used were knives for epiphytic (bark) species and paper bags and pens. Specimens were collected following altitudinal gradients with 2400m, 2600m and 2900m.

Along the trail, some of species were immediately identified by the trainer and determination keys were illustrated to the trainees (Figure 4). Trainees were keen on identification keys which helped them to acquire more skills during the field work.



Figure 4. Trainer explaining traits of bryophytes for identification

GPS points of all samples plots were taken used Garmin device. Lenses were used to observe traits of bryophyte species in order to facilitate the identification on the field (Figure 5).



Figure 5. Trainees observing bryophyte species assisted by the trainer

Most of bryophytes found during the training were not yet identified or not recorded in this forest. For instance, on Bigugu Mountain mosses and liverworts were abundant. Some moss species such as *Orthostichella rigida* were abundant in the middle of Bigugu Mountain (Figure 6).



Figure 6. *Orthostichella rigida* nesting in angiosperm trees

Near the peak of Bigugu different species of *Breutelia* such as *Breutelia stuhlmanii* and *Breutelia diffracta* were abundant (Figure 7).



Figure 7. *Breutelia stuhlmanii* to the left and *Breutelia diffracta* to the right

Along Kamiranzovu water fall trail, the liverwort *Dumortiera hirsuta* was the most dominant (Figure 8).



Figure 8. *Dumortiera hirsuta*: Liverwort species found along the trail of Kamiranzovu water fall

Identification of specimens in the laboratory

In each visited sites, specimen of bryophytes were collected and immediately identified on the field where possible using lenses. For most of bryophyte species, the identification on the field was not easier since it was not possible to take all necessary material to the field such as microscopes. It is in this regard, unidentified specimens were brought to National University of Rwanda for identification in the laboratory.

The identification of collected specimens was carried out in National University of Rwanda, Botany laboratory of biology department. All trainees together with the trainer, worked on ID by means of lenses, dissection microscope and other microscopes.

Conclusion

The training was ended by an evaluation consisting of open questions about theoretical lectures as well as practical questions about the identification of different species of bryophytes. Based on the results of the evaluation, the training was successful. Besides, all

trainees were satisfied with new knowledge and skills got from the training. In addition, copies of all documents about bryophytes were taken and kept for further identification and further studies.

Although the training was successful, due to the time limited for field work, only 4 sites of Nyungwe forest were visited. Further trainings on bryophytes involving non visited sites are needed in order to explore more bryophytes diversity nested in Nyungwe National Park. It is also needed to train graduate students in Bryology to make this achievement more sustainable.

APPENDIX I

Course outline

October 1: Formal Lecturing Session

Bryophytes: Key Groups in the Origin of Land Flora

Hornworts: Anthocerotophyta

Liverworts (Marchantiophyta): An Overview

Liverworts, the small orders and the Simple Thalloids (Metzgeriales)

Liverworts; the leafy groups (Jungermanniales) and the complex thalloids (Marchantiales)

October 2: Formal Lecturing Session

The mosses – an overview, the Andreales and Sphagnales

Mosses: Nematodontous orders especially Polytrichales

Mosses: Bryiidae, Diplolepideous-opposite and Haplolepideous groups

Mosses – Diplolepideous – alternate lineages

Bryophytes – phylogeny and evolution

Bryophytes: Ecological considerations

Rwanda in context: Bryophyte diversity patterns in Africa

October 3 – October 11: Field Course, Nyungwe National Park

This portion of the course will comprise five main elements:

- 1) A Discussion of collecting techniques, data recording, and documentation.
- 2) Daily excursions to representative habitats to survey bryophyte diversity.
- 3) Afternoon sessions on identification techniques in selected species-rich or ecologically important groups.
- 4) Afternoon-Evening identification sessions, where we will work on material collected each day.
- 5) A brief introduction to ecological sampling techniques. If time permits we will sample.

Evaluation:

Participants will be evaluated under the following criteria:

- 1) Prepare a collection of 20 properly preserved specimens with appropriate documentation (labels).
- 2) Pass an identification test based on 10 unknown specimens selected by me.
- 3) Complete a comparative evaluation of diversity either 1) among related microhabitats within the same habitat type, or 2) among different forest types for the same microhabitat